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Research article

THE IMPACT OF VEHICULAR POLLUTION ON SOIL CHARACTERISTICS AT MUZAFFARPURNAGAR

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ABSTRACT: To the study of field was conducted on vegetation at Muzaffarpurnagar of Uttar Pradesh. Impact of vehicular pollution on soil characteristics; six soil characteristics and physical characteristics of soil was recorded for two years (2004-06). Physical characteristic of soil showed high moisture content (%) at as well as soil pH, water holding capacity and organic carbon maximum A site and minimum C site concentration of exchangeable bases and heavy metal are maximum at C site and minimum at A residential site

Kay words: Muzaffarpurnagar, soil characteristics, Vehicular pollution, exchangeable bases.

INTRODUCTION

The industrial and vehicles deposition of air pollutants in soil system through dry and wet deposition processes were major phenomena of removal of pollutants from the atmosphere [13]. Road sites continuously receive dust particles during transportation of low and heavy duty vehicles. Pollutants through vegetation and their subsequent death and release during decomposition, other indirect routes of pollutants leading to the soil and change the soil characters. Deposition of pollutants on vegetation into the soil by through fall and stem flow. Soil surface acts as a major sink for gaseous and particulate pollutant. Pollutant induced changes in Physico-chemical properties of the soil were quantified, change in soil pH cause mineral imbalance in the soil [1, 7]. Since particulate pollutants contain considerable amounts of heavy metals, their deposition in the soil me alter the metals cycling [9] and me create toxicity to plants growth process [3,4].

MATERIAL AND METHODS

The present study was conducted on vegetation at Muzaffarnagar of Uttar Pradesh India.

Soil characteristics

Six soil characteristic sites were selected on vegetation at Muzaffarnagar namely 'A' Residential site, B State highway, C National highway and D, E, and F miner road sites. Site C is maximum pollutants in compared to the 'A' residential sites. Soil characteristics data were collected for the year 2002-2004 soil samples were collected from 10-15 location about 10 cm beneath the soil surface at monthly interval each site around different plants species. Soil sample were mixed to get composite soil representing a particular season. Soil physic-chemical features have altered unfavorably due to the atmospheric deposition and accumulation of gaseous and particulate pollutants. Soil textures were determined by hydrometer described by [12]. Moisture was determined by fresh soil sample was weighted and then dried at 105˚C for about 24 hours and then reweighted water holding capacities were determined by [12]. The soil pH was measured in the suspension of 1:5 (soil-water) with the help of a photo volt, pH meter using a glass electrode [8].

Organic carbons were determined by Walkley and Blacks rapid titration method [2]. Total nitrogen determined by using Kjelbahl technique [6]. Estimating of exchangeable bases, Ca^{2+}, K^{+}, Na^{+} determine with a flame photometer type 121 (Systronics Midi flame 127, India) and Mg by atomic absorption spectrophotometer (Model 2380, Perkin Elmer, USA) Heavy Metal (Ni, Cr, Pb, Cd, Mn and Zn) concentration in the soil were determined by extracting in the Diethelene Tramine Pentacutic Acid (DTPA). The extract were stored in polyethylene bottles at 4°C and DPTA extractable elements were quantified by using and Atomic Absorption Spectrophotometer (Model-2380, Perkin Elemer, USA).

RESULT AND DISCUSSION

The soil characteristics on vegetation at Muzaffarnagar there was not significant at different study sites. The soil pH was more or less, neutral; the values 6.94 to 6.92 (Table-1). The neutral pH of the soil is due to the abundance of base cat ions like Ca^{++} at exchange sites in a reversible and rapid reaction [16]. Maximum soil moisture and water holding capacity were recorded at controlled (A) site and minimum at state highway (c) site due to higher plant cover at former sites maintained higher moisture in soil. Redistribution and aggregation of particles due to altered soil processes and lower canopy cover may have reduced the water holding capacity B, C sites as compared to D, E, F and then control A site. Soil from B, C sites showed higher proportion of sand than D E F and A control sites. Fragmentation, redistribution and aggregation of particles are dependent on development of vegetation and consequent soil processes. At road sites, soil processes have drastically altered due to continuous disturbances and slow rate of vegetation development. Road side continuously receives dust particles during transpiration of low and heavy duty vehicle. Organic carbon was maximum at A site and minimum at C site the values 0.97 to 0.52% respectively (Table-1) organic carbon of the total nitrogen and phosphorus was maximum at A site followed by F, E, D, B and minimum at C site the total nitrogen valued range between 0.070 to 0.079% A site and 0.039 to 0.040% E site. The total phosphorus in soil varied between 8.0 to 9.0 mgg^{-1} at A site and 3.3 to 4.0 mgg^{-1} at C site. Total nitrogen and phosphorus minimum at C site (Table-6 and 7) may also be related to low organic matter. Soil of road sites contained higher concentration of toxic metals which may also have adversity affected the soil biological activity.

Discretion of ecosystem functioning [14] and deletion of soil carbon pool [11] were reported due to movement of heavy duty vehicles movement of vehicles also causes los of litter layer which is an integral storage and exchange site for nutrients in green belt site higher soil carbon pool due to development of vegetation cover.

Exchangeable Ca in different plant species showed maximum concentration at site C and minimum at site A (Table-2) these values 3.92 mgg^{-1} and 1.07 mgg^{-1}in soil sample collected around E. Hybrid and A. auriculiformis respectively due to the high atmospheric deposition as well as higher concentration of Ca in parent rocks. Increase in Ca due to atmospheric deposition reported by [17], K, Mg and showed maximum concentration at site 'A' and minimum at site B. C Na maximum C site (Table-3 and 4) in soil at different plant species Since soil organic matter at B, C site very low K and Mg comes into the soil from organic matter, thus was lower concentration of these at C, B site due lower vegetation cover. Higher Na concentration at highly polluted sites due to higher deposition of Na during deposition of particulates and loose dust particles (Table-5). All the heavy metals (Ni, Cr, Pb, Cd, Mn and Zn) showed maximum concentration at site C followed by B, D, E, F and minimum at 'A' site in soil around different plants species. Nickel concentration (mgg^{-1}) at A site (Table-8) respectively $month^{-1}$ were found in soil around *A. indica.* Cr concentration varied between 14.7 to 28.10, and 3.01 to 5.20 (Table-9), Pb concentration between 11.37 to 22.30 and 2.0 to 5.0 (Table-10), Cd concentration between 3.34 to 9.75 and 1.0 to 2.1 (Table-11), Mn concentration between 58.16 to 165.40 and 9.1 to 18.32 (Table-12) and Zn concentration between 510.12 - 100.00 to 217.10 (Table-13) respectively. Site C, high concentration of heavy metals have been found to inhabit the activity of acid phosphates enzymes [15] leading to reduced decomposition of organic phosphorus. Ni and Cr showed maximum C site and minimum A site, that their special distribution in more around the source. Lead concentration was quite low in A control site as compared to those C site reported from urban area [5,10].

Table-1. Physical characteristics of soils at different study sites on vegetation at Muzaffarnagar during 2002-04 (Mean±SE)

Sites	Moisture content (%)	pH	Water holding capacity	Organic carbon	Texture %		
					Sand	Silt	Clay
A.	14.25±0.12	6.94±0.004	56.07±0.39	0.97±0.005	61.89±0.6	31.00±0.33	9.00±1.23
B	8.06±0.04	6.81±0.005	46.30±0.16	0.52±0.0033	70.5±0.10	24.28±0.18	5.96±0.56
C	5.13±0.05	6.72±0.07	44.94±0.45	0.76±0.004	69.80±0.5	24.06±0.27	5.08±0.36
D	10.45±0.17	6.78±0.005	50.87±0.41	0.792±0.003	65.8±0.32	29.00±0.5	6.02±0.38
E	13.01±0.18	6.88±0.03	53.00±0.16	0.92±0.0018	63.46±0.33	30.18±0.16	6.42±0.42
F	13.48±0.12	6.92±0.003	54.57±0.32	0.94±0.003	62.88±0.28	30.62±0.56	7.12±0.8

Table-2. Concentration of exchangeable calcium (mgg-1) in soil collected around different plant species at different study sites.

Plant species	Sites					
	A	B	C	D	E	F
A. auriculiformis	1.07	3.13	3.26	2.83	2.40	2.10
A. indica	1.50	3.10	3.92	2.96	2.43	2.15
D. sissoo	1.86	3.72	3.83	3.20	2.96	2.38
E. hybrid	1.89	3.48	3.51	3.10	2.85	2.42
C. siamea	1.87	3.30	3.42	2.85	2.52	2.26
D. regia	1.49	3.40	3.71	2.95	2.56	2.16

Table-3. Concentration of exchangeable potassium (mgg-1) in soil collected around different plant species at different study sites.

Plant species	Sites					
	A	B	C	D	E	F
A. auriculiformis	0.698	0.280	0.248	0.348	0.425	0.580
A. indica	0.713	0.340	0.337	0.400	0.460	0.573
D. sissoo	0.775	0.381	0.347	0.393	0.437	0.560
E. hybrid	0.691	0.290	0.180	0.378	0.403	0.561
C. siamea	0.700	0.308	0.200	0.338	0.433	0.579
D. regia	0.789	0.347	0.125	0.363	0.476	0.610

Table-4. Concentration of exchangeable magnesium (mgg-1) in soil collected around different plant species at different study sites.

Plant species	Sites					
	A	B	C	D	E	F
A. auriculiformis	0.898	0.345	0.300	0.370	0.400	0.509
A. indica	0.700	0.320	0.260	0.383	0.502	0.525
D. sissoo	0.850	0.303	0.290	0.402	0.468	0.600
E. hybrid	0.835	0.288	0.302	0.360	0.450	0.570
C. siamea	0.760	0.340	0.354	0.374	0.480	0.592
D. regia	0.783	0.246	0.290	0.320	0.463	0.601

Table-5. Concentration of exchangeable sodium (mgg1-) in soil collected around different plant species at different study sites

Plant species	Sites					
	A	B	C	D	E	F
A. auriculiformis	0.100	0.320	0.398	0.240	0.145	0.109
A. indica	0.070	0.319	0.413	0.219	0.123	0.198
D. sissoo	0.92	0.290	0.387	0.235	0.148	0.101
E. hybrid	0.106	0.382	0.410	0.230	0.120	0.118
C. siamea	0.074	0.281	0.370	0.200	0.150	0.080
D. regia	0.092	0.310	0.402	0.199	0.125	0.082

Table-6. Amount of total N% soil collected around different plant species at different study sites at Muzaffarnagar.

Plant species	Sites					
	A	B	C	D	E	F
A. auriculiformis	0.070	0.040	0.039	0.057	0.059	0.062
A. indica	0.085	0.042	0.041	0.049	0.051	0.061
D. sissoo	0.090	0.039	0.037	0.053	0.058	0.081
E. hybrid	0.072	0.042	0.033	0.049	0.053	0.069
C. siamea	0.089	0.043	0.038	0.045	0.056	0.064
D. regia	0.079	0.043	0.041	0.058	0.059	0.065

Table-7 Amount of total P (mgg-1) in soil collected around different plant species at different study sites at Muzaffarnagar.

Plant species	Sites					
	A	B	C	D	E	F
A. auriculiformis	8.00	4.19	3.30	6.53	6.75	7.89
A. indica	9.01	4.38	4.00	6.41	7.00	8.03
D. sissoo	8.67	3.80	3.12	5.70	6.12	7.30
E. hybrid	7.89	3.59	3.00	5.42	5.19	6.78
C. siamea	9.02	3.40	2.32	5.26	5.85	7.82
D. regia	8.66	3.80	3.17	5.38	6.00	7.30

Table-8. Nickel concentration ($\mu g g^{-1}$) in soil around different plant species at different study sites at Muzaffarnagar (Mean ± SE).

Plant species	Sites					
	A	B	C	D	E	F
A. auriculiformis	5.32±0.03	11.20±0.03	12.70±0.05	10.18±0.03	7.00±0.3	6.48±0.05
A. indica	3.08±0.03	8.85±0.05	11.00±0.03	7.82±0.05	4.30±0.3	3.70±0.03
D. sissoo	1.12±0.003	9.30±0.05	12.16±0.03	6.80±0.03	5.30±0.4	3.78±0.03
E. hybrid	2.35±0.5	6.00±0.03	8.93±0.03	5.09±0.05	3.17±0.04	2.40±0.05
C. siamea	4.63±0.03	8.00±0.05	8.89±0.03	6.97±0.3	6.00±0.5	4.40±0.04
D. regia	2.00±0.03	7.03±0.05	8.90±0.05	5.56±0.03	4.00±0.05	3.96±0.03

Table-9. Chromium concentration (µgg^{-1}) in soil around different plant species at different study sites at Muzaffarnagar (Mean±SE).

Plant species	Sites					
	A	B	C	D	E	F
A. auriculiformis	5.20±0.03	14.35±0.03	17.60±0.05	9.68±0.03	8.80±0.03	6.00±0.03
A. indica	4.01±0.05	13.10±0.05	15.16±0.03	9.00±0.05	7.87±0.03	6.00±0.05
D. sissoo	3.01±0.03	15.75±0.05	19.00±0.30	9.80±0.05	6.98±0.005	5.30±0.05
E. hybrid	3.98±0.005	13.70±0.05	14.70±0.005	1.00±0.003	8.30±0.05	6.02±0.03
C. siamea	4.00±0.03	20.30±0.03	28.10±0.003	8.00±0.005	6.72±0.03	5.20±0.5
D. regia	4.60±0.30	15.10±0.05	17.18±0.03	11.026±0.05	7.09±0.003	6.40±0.05

Table-10. Lead concentration (µgg^{-1}) in soil around different plant species at different study sites at Muzaffarnagar (Mean±SE).

Plant species			Sites			
	A	B	C	D	E	F
A. auriculiformis	2.00±0.03	9.07±0.03	12.38±0.06	6.20±0.04	5.00±0.03	3.79±0.02
A. indica	2.76±0.03	8.34±0.06	12.00±0.003	7.03±0.005	6.62±0.03	3.189±0.05
D. sissoo	3.00±0.03	13.12±0.06	17.29±0.50	10.48±0.32	7.49±0.003	4.37±0.05
E. hybrid	2.70±0.05	7.15±0.003	11.39±0.05	8.10±0.3	6.03±0.005	3.20±0.05
C. siamea	5.00±0.03	20.07±0.03	22.30±0.05	16.58±0.30	13.50±0.52	9.31±0.5
D. regia	2.10±0.003	9.06±0.05	11.37±0.005	7.45±0.003	4.90±0.3	3.83±0.50

Table-11. Cadmium concentration (µgg^{-1}) in soil around different plant species at different study sites at Muzaffarnagar (Mean±SE).

Plant species	Sites					
	A	B	C	D	E	F
A. auriculiformis	1.00±0.05	3.27±0.05	3.34±0.03	2.90±0.05	2.08±0.05	1.62±0.006
A. indica	1.30±0.03	4.90±0.05	5.39±0.03	4.00±0.003	3.08±0.03	3.01±0.03
D. sissoo	2.10±0.03	6.30±0.03	9.75±0.05	4.80±0.05	3.59±0.03	3.10±0.05
E. hybrid	1.98±0.05	3.80±0.02	4.38±0.3	3.09±0.03	2.87±0.05	2.60±0.003
C. siamea	1.93±0.05	3.98±0.03	4.20±0.04	3.89±0.005	2.70±0.03	2.21±0.03
D. regia	1.02±0.02	4.00±0.05	4.92±0.03	3.13±0.03	2.98±0.02	1.90±0.005

Table-12. Manganese concentration (µgg^{-1}) in soil around different plant species at different study sites at Muzaffarnagar (Mean±SE).

Plant species	Sites					
	A	B	C	D	E	F
A. auriculiformis	10.10 ±0.03	50.27 ±0.03	87.42 ±0.06	48.61±0.05	40.27 ±0.03	25.18±0.031
A. indica	12.98±0.003	63.20 ±0.32	74.39±0.053	56.63±0.33	46.03 ±0.03	32.10 ±0.05
D. sissoo	11.80 ±0.03	80.73 ±0.05	98.91 ±0.03	75.20±0.04	62.30±0.003	31.13 ±0.04
E. hybrid	9.10 ±0.003	39.38 ±0.02	58.16 ±0.53	32.19±0.30	30.00 ±0.05	16.09 ±0.36
C. siamea	18.32 ±0.03	118.30±0.50	165.40±0.63	59.11±0.43	62.03 ±0.30	40.01 ±0.03
D. regia	13.12 ±0.03	59.20 ±0.52	64.10 ±0.50	52.27±0.03	41.16 ±0.05	23.17 ±0.04

Table-13. Zinc concentration (µgg^{-1}) in soil around different plant species at different study sites at Muzaffarnagar (Mean±SE).

Plant species	Sites					
	A	B	C	D	E	F
A.auriculiformis	100.00±0.35	454.35±0.40	510.12±0.30	288.48±0.38	254.18±0.27	160.19±0.51
A. indica	153.04±0.35	507.17±0.40	708.09±0.53	360.00±2.00	300.70±0.38	240.50±0.50
D. sissoo	200.07 ±3.0	890.37 ±5.0	1210.18±5.01	600.81 ±3.0	470.39 ±5.0	301.02 ±3.0
E. hybrid	205.00±0.50	892.53 ±5.0	1350.19±5.03	710.11 ±3.0	620.10±3.05	308.09±0.40
C. siamea	102.20 ±0.3	910.17±0.50	1219.01 ±3.0	510.19±0.58	435.13±0.40	411.00±3.12
D. regia	217.10 ±3.0	1152.03±5.0	13130.00±5.08	600.05±0.50	480.17 ±3.0	330.11±0.40

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